WHAT IS CLAIMED IS:

1. A method for making a holographic reticle, the method comprising the steps of:

(1) receiving two beams of coherent optical radiation;

(2) interfering said two beams, resulting in an interference volume of optical radiation having an interference pattern; and

(3) recording said interference pattern in a recording medium.

2. The method of claim 1, further comprising the steps of:

(4) receiving a single beam of coherent optical radiation; and

(5) splitting said single beam into said two or more beams of optical radiation.

375/1-35 15

3. The method of claim 1, wherein said interfering step results in the interference pattern being useful for characterizing an optical system.

4. The method of claim 1, wherein said interfering step results in the interference pattern comprising a grating.

5. The method of claim 4, wherein said interfering step further comprises:

causing the grating to have linewidths and spacings that are based on properties of said interfering beams.

6. The method of claim 4, wherein said interfering step further comprises:

causing the grating to be a linear grating having a substantially constant pitch.

7. The method of claim 6, wherein said interfering step further comprises:

causing the linear grating to have a duty cycle that varies.

8. The method of claim 4, wherein said interfering step further comprises:

causing the grating to have a plurality of lines having multiple orientations.

9. The method of claim 4, wherein said interfering step further comprises:

causing the grating to be a chirped grating having a controlled pitch variation.

10. The method of claim 4, wherein said interfering step further comprises:

causing the grating to be a cross grating.

11. The method of claim 4, wherein said interfering step further comprises:

causing the grating to be a polygonal grating.

12. The method of claim 4, wherein said interfering step further comprises:

causing the grating to be a zone plate array.

13. The method of claim 4, wherein said interfering step further comprises:

causing the grating to be a multiplexed grating with multiple axes of symmetry of controlled pitch and pitch uniformity.

14. The method of claim 1, further comprising the step of:

(4) manipulating a wavefront of one or more of said beams prior to step (2), in accordance with a desired interference pattern.

15. The method of claim 14, wherein step (4) comprises the step of expanding two of said beams, resulting in two diverging spherical wavefronts that interfere and produce an interference pattern with a linear grating.

16. The method of claim 14, wherein step (4) comprises the step of spatially filtering said one or more beams.

17. The method of claim 14, wherein step (4) comprises the steps of:

(a) manipulating a first beam to have a cylindrical wavefront; and

(b) manipulating a second beam to have a planewave wavefront.

18. The method of claim 17, wherein step (2) comprises the step of interfering said first beam and said second beam, thereby producing an interference pattern having a chirped grating with a controlled pitch variation.

19. The method of claim 14, wherein step (4) comprises the steps of:

(a) manipulating a first beam to have a spherical wavefront; and

(b) manipulating a second beam to have a planewave wavefront.

20. The method of claim 19, wherein step (2) comprises the step of interfering said first beam and said second beam, resulting in a zone plate array.

21. The method of claim 1, wherein step (3) comprises the step of generating a test reticle having said interference pattern.

22. The method of claim 21, wherein step (3) comprises the steps of:

(a) exposing photo-resist that is deposited on a reticle with said interference pattern; and

(b) developing said photo-resist so that said reticle reflects said interference pattern.

23. The method of claim 1, wherein said interference pattern comprises a grating, further comprising the step of:

(a) generating precision phase shifts between adjacent grating patches to monitor image shifting aberrations.

24. The method in claim 23, wherein said step (a) comprises the step of:

(I) phase shifting a holographic reference beam relative to an object beam.

25. The method of claim 24, wherein said step (I) is performed using an electro-deformable device.

26. The method of claim 24, wherein said step (I) is performed using an acoustic-optic device.

27. The method of claim 24, wherein said step (I) is performed using a nano-actuated optic device.

28. The method of claim 27, wherein said nano-actuated optic device is one of a piezo-driven mirror and a bimorph-driven mirror.

29. The method of claim 24, wherein said step (I) is performed using one of a reflective array, a refractive array, a diffractive array, a nano-deformable reflective array, a nano deformable refractive array, and a nano deformable diffractive array.

30. The method of claim 24, wherein said step (I) is performed using one of a MEMS mirror array and an electro-deformable hologram.

31. The method of claim 24, wherein said step (I) is performed using an electronic fringe-locking system.

32. A method for making a holographic reticle, the method comprising the steps of:

(1) receiving two beams of coherent optical radiation;

(2) manipulating a wavefront of one or more of said beams in accordance with a desired interference pattern;

(3) interfering said two beams, resulting in an interference volume of optical radiation having an interference pattern; and

(4) recording said interference pattern in a recording medium.

33. The method of claim 32, wherein step (2) comprises the step of expanding two of said beams, resulting in two diverging spherical wavefronts that interfere and produce an interference pattern with a linear grating.

34. The method of claim 32, wherein step (2) comprises the step of spatially filtering said one or more beams.

35. The method of claim 32, wherein step (2) comprises the steps of:

(a) manipulating a first beam to have a cylindrical wavefront; and

(b) manipulating a second beam to have a planewave wavefront.

36. The method of claim 35, wherein step (3) comprises the step of interfering said first beam and said second beam, thereby producing an interference pattern having a chirped grating with a controlled pitch variation.

37. The method of claim 32, wherein step (2) comprises the steps of:

(a) manipulating a first beam to have a spherical wavefront; and

(b) manipulating a second beam to have a planewave wavefront.

38. The method of claim 37, wherein step (3) comprises the step of interfering said first beam and said second beam, resulting in a zone plate array.

39. A method of using a holographic reticle to characterize an optical system, the method comprising the steps of:

(1) placing the holographic reticle in a path of an optical beam within the optical system;

(2) recording an image produced by the path of the optical beam passing through the holographic reticle; and

(3) analyzing the image to characterize the optical system.

40. The method of claim 39, wherein step (1) comprises:

placing the holographic reticle in a path of an optical beam within the optical system such that a first plane containing the reticle is positioned obliquely to a second plane where the image is recorded.

41. The method of claim 40, wherein the holographic reticle has a plurality of feature sets thereon.

42. The method of claim 41, wherein the plurality of feature sets includes at least one of a periodic pattern and a grating pattern.

43. The method of claim 40, wherein the second plane is positioned in a volume of space that includes a depth of focus of the optical system.

44. The method of claim 39, wherein step (2) comprises:

recording the image produced by the path of the optical beam passing through the holographic reticle in a recording medium.

45. The method of claim 39, wherein the recording medium is a photosensitive substrate.

46. The method of claim 39, wherein step (3) comprises:

analyzing the image to extract a feature image shift.

47. The method of claim 39, wherein step (3) comprises:

analyzing the image in real time using a demodulating device to characterize the optical system.

48. The method of claim 39, wherein step (3) comprises:

analyzing the image to extract a Zernike aberration.

49. The method of claim 39, wherein step (3) comprises:

analyzing the image interferometrically to produce an interferogram having one or more tilts and one or more pistons that represent at least one optical parameter of the optical system.

50. The method of claim 49, further comprising the steps of:

(a) detecting an image shift based on said pistons; and

(b) detecting magnification parameters based on said tilts.

51. The method of claim 39, further comprising the step of:

(c) detecting non-uniform distortion parameters based on said pistons and tilts.

52. The method of claim 51, wherein said non-uniform distortion parameters are detected as a function of a variation in linewidth.

53. The method of claim 51, wherein said non-uniform distortion parameters are detected from a non-linear phase front of a chirped grating structure.

54. The method of claim 39, wherein step (3) comprises:

comparing the image with another recorded image to deconvolve higher order aberrations in the optical system from lower order aberrations.

55. The method of claim 54, wherein said comparing step further comprises:

determining the relative shift differences due to the different partial coherence conditions of the recorded images.

56. The method of claim 39, wherein the holographic reticle includes a pattern of linewidths such that each linewidth is an integral multiple of a fundamental linewidth.

57. The method of claim 56, wherein step (3) comprises:

analyzing the image for relative image shifts at a single interferometric angle.